APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/821,430	04/09/2004	Robert E. Cypher	5181-95901	1241

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EXAMINER
THOMAS, SHANE M

ART UNIT	PAPER NUMBER
2186	

DATE MAILED: 05/19/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

	Application No.	Applicant(s)
Office Action Summary	10/821,430	CYPHER, ROBERT E.
	Examiner	Art Unit	
	Shane M. Thomas	2186	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on <u>09 April 2006</u>.

2a) ☐ This action is **FINAL**.   2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) <u>1-32</u> is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) <u>1-5,9,10,13,14,17-21,25,26,29 and 30</u> is/are rejected.

7) ☒ Claim(s) <u>6-8,11,12,15,16,22-24,27,28,31 and 32</u> is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on <u>09 April 2004</u> is/are: a)☒ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All b)☐ Some * c)☐ None of:

      1. ☐ Certified copies of the priority documents have been received.

      2. ☐ Certified copies of the priority documents have been received in Application No. _____.

      3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>2/11/2005</u>.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

This Office action is responsive to the application filed 4/9/2006. Claims 1-32 are presented for examination and are currently pending.

In the response to this Office action, the Examiner politely requests that support be shown for language added to any original claims on amendment and any new claims. That is, indicate support for newly added claim language by specifically pointing to page(s) and line numbers in the specification and/or drawing figure(s). This will assist the Examiner in prosecuting this application.

Excerpts from all prior art references cited in this Office action shall use the shorthand notation of [column # / lines A-B] to denote the location of a specific citation. For example, a citation present on column 2, lines 1-6, of a reference shall herein be denoted as "[2/1-6]."

Specification

The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Objections

Claims 7-13 and 23-29 objected to because of the following informalities:

As per claims 7 and 23, the term --said second snoop indications-- should be amended to

--said second snoop **filter** indications-- as the former term has not been previously defined in the

claims.

As per claims 8 and 24, the term --said second snoop indication-- should be amended to

--said second snoop **filter** indications-- as the former term has not been previously defined in the

claims.

As per claims 13 and 29, the term --entrees-- should be corrected to --entries--.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the
> subject matter which the applicant regards as his invention.

Claims 9,10,13,25,26, and 29, are rejected under 35 U.S.C. 112, second paragraph, as

being indefinite for failing to particularly point out and distinctly claim the subject matter which

applicant regards as the invention.

As per claims 9 and 25, it is not clear whether the terms --said storage--, --said plurality

of entries--, and --said snoop filter indications-- refer to the first (claims 1,17) or second storage

(claims 5,21), the first (claims 1,17) or second plurality of entries (claims 5,21), and the first

(claims 1,17) or second snoop filter indications (claims 5,21), respectively, as the terms --said

storage--, --said plurality of entries--, and --said snoop filter indications-- all lack proper

antecedent basis. Nonetheless, for the purposes of examination, with reference to ¶¶34-35 of Applicant's originally-filed specification, the Examiner has considered the aforementioned terms to be the storage, plurality of entries, and snoop filter indications of the "first" storage, as defined in claims 1 and 17.

As per claims 13 and 29, it is not clear whether the terms --said storage-- and --said plurality of entries-- refer to the first (claims 1,17) or second storage (claims 5,21) and the first (claims 1,17) or second plurality of entries (claims 5,21), respectively, as the former terms lack proper antecedent basis. Nonetheless, for the purposes of examination, with reference to ¶¶34-35 of Applicant's originally-filed specification, the Examiner has considered the aforementioned terms to be of the storage and plurality of entries of the "first" storage, as defined in claims 1 and 17.

Claims 10 and 26 are rejected as being dependent upon rejected base claims.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-5,14,17-21, and 30, are rejected under 35 U.S.C. 103(a) as being unpatentable

Coulson (U.S. Patent No. 6,725,342).

As per claims 1 and 17, Coulson teaches in [6/32-53] a **storage** (cache directory table)

including a plurality of entries to store corresponding snoop filter indications (i.e. data

which indicates the presence of the requested data in the cache 500) and **a cache controller** 453

(figure 4) **configured to receive a transaction request including an address and to generate**

an index for accessing said storage (directory) **by performing a hash function on the**

address. Coulson does not specifically state that the cache controller uses the address of the

request in the hash function when determining whether or not the request data is in the cache;

however, it would have been obvious to one having ordinary skill in the art at the time the

invention was made to have seen that in order to properly determine whether a given piece of

data is in the cache, the system would have had to use the address of the request (as general

caching uses to discern whether data is in a cache) as the input to the hash. Further, Coulson

teaches in [6/32-53] **said cache controller further configured to selectively generate a snoop**

request operation (i.e. a cache request for the data) **to said cache memory** 500 **for said**

transaction request dependent upon a snoop filter indication (indication of the hashed to

directory entry) **stored in said storage** (cache directory) **that corresponds to said address**, as it

would have been obvious to one having ordinary skill in the art to have seen that the cache 500
would have only been accessed it the corresponding cache directory entry would have indicated
that the requested data was indeed in the cache.

As per claims 2 and 18, Coulson does not specifically teach in [6/32-53] that **said cache
controller is configured to generate said snoop response to said cache memory for said
transaction request if said snoop filter indication is a value indicative that a cache line**
(specific data set) **corresponding to said address was stored within said cache memory**;
however, it would have been obvious to one having ordinary skill in the art at the time the
invention was made to have seen that if a corresponding entry of the cache directory would have
indicated that a specific set of data was indeed in the cache 500, then the cache controller would
have requested access to the cache (i.e. by generating a snoop operation), such is the purpose of
the entries of the cache directory as taught by Coulson.

As per claims 3 and 19, Coulson does not specifically teach in [6/32-53] that **said cache
controller is configured to ignore said transaction request if said snoop filter indication is a
value indicative that a cache line corresponding to said address is not stored within said
cache memory**; however, it would have been obvious to one having ordinary skill in the art at
the time the invention was made to have seen that if a corresponding entry in the cache directory
indicated that the requested data was not in the cache, it would have further been seen that the
cache controller 453 would have ignored the request and not had to search the cache, such is the
purpose of the entries of the cache directory as taught by Coulson.

As per claims 4 and 20, Coulson teaches **wherein during a first mode of operation**
(which the Examiner is considering to be normal cache directory operation as Coulson does not

teach multiple modes of operation) **and in response to a cache memory access, said cache**

controller is configured to store said snoop filter indication (data stored in an entry of the

cache directory table) **in an entry of said storage** (cache directory table) **having an index**

(which the Examiner is considering to be the result of the hashing algorithm for a given

requested address) **equal to the hash value of an address associated with said cache line**, as

such functionality is well known and inherently associated with hashing. In other words, by

using a hashing algorithm to search the cache directory table as discussed in [6/32-53], it is

necessarily inherent that the cache controller, once the input address is hashed, that the resultant

index output be used to index into a corresponding address of the cache directory table in order

to ascertain whether a corresponding data element is in the cache 500.

As per claims 5 and 21, Coulson teaches the claimed invention expect for **a second**

storage including a plurality of entries configured to store second snoop filter indications.

It would have been obvious to one having ordinary skill in the art at the time the invention was

made to have utilized a second such cache directory table, since it has been held that mere

duplication of the essential working parts of a device involves only routine skill in the art. Refer

to MPEP §2144.04 (v) and (vi).

As per claims 14 and 30, Coulson teaches in [6/54-67] **said cache memory** 500

including a plurality of portions (cache entries) **and each portion of said cache memory**

corresponds to a respective portion (particular entry of the cache directory table) **of said**

plurality of entries of said storage (cache directory table). Coulson teaches in [6/54-67] that

the entries of the cache directory table correspond one-to-one with the entries of the cache 500.

Allowable Subject Matter

Claims 6-8,11,12,15,16,22-24,27,28,31, and 32, are objected to as being dependent upon

a rejected base claim, but would be allowable if rewritten in independent form including all of

the limitations of the base claim and any intervening claims.

Claims 9,10,13,25,26, and 29 would be allowable if rewritten to overcome the

rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all

of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter:

As per claims 6 and 22, the prior art of record does not specifically teach **a second mode**

of operation, where when in the second mode, **the cache controller is further configured to**

selectively generate a snoop operation to said cache memory for said transaction request

dependent upon a second snoop filter indication stored in said second storage that

corresponds to said address. Specifically, Coulson does not teach a second mode using a

second cache directory table to determine if a specific set of data is contained in the cache 500.

As per claims 15 and 31, the prior art of record does not specifically teach **generating a**

snoop operation to a given one of said portions of said cache memory if said corresponding

respective portion of said plurality of entries of said storage is populated with a

predetermined number of said snoop filter indications. Specifically, Coulson only teaches a

single snoop filter indications for each entry of the cache 500 as discussed.

Claims 7-13,16,23-29, and 32 are allowable over the prior art of record as being

dependent upon allowable base claims.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Chiou et al. (U.S. Patent No. 6,370,622) teaches using a lower-level cache Ca2 (figure 3) as a snoop filter to only propagate transactions involving cache lines that are in the higher-level cache (Ca1) - column 4, line 43-61.

Richard et al. (U.S. Patent Application Publication No. 2003/0093630) teaches executing a snoop operation when an incoming hashed address collides with an existing tag entry whose existing state is owned - ¶45.

Dieffenderfer et al. (U.S. Patent Application Publication No. 2004/0186964) teaches a snoop filter capable of parsing (not hashing) a snoop request and determining whether the data might be in a cache (abstract).

Safranek et al. (U.S. Patent Application Publication No. 2004/0003184) teaches a allocating snoop filter entries in response to initial accesses of a local cache by a remote cache (abstract).

Anderson et al. (U.S. Patent Application Publication No. 2003/0177317) teaches a replacement scheme for snoop filter entries.

Phelps (U.S. Patent No. 5,966,729) teaches only broadcasting an address request to processors likely to contain the requested data via use of a snoop filter (abstract).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shane M Thomas whose telephone number is (571) 272-4188. The examiner can normally be reached M-F 8:30 - 5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matt M Kim can be reached at (571) 272-4182. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Shane M. Thomas

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